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CONCLUSION TO THE FIRST PART.

The preceding pages contain the execution of the first part of our plan; being an attempt to establish general principles respecting the systems of rays produced by the ordinary reflexion of light, at any mirror or combination of mirrors, shaped and placed in any manner whatsoever; and to shew that the mathematical properties of such a system may all be deduced by analytic methods from the form of ONE CHARACTERISTIC FUNCTION: as, in the application of analysis to geometry, the properties of a plane curve, or of a curve surface, may all be deduced by uniform methods from the form of the function which characterises its equation. It remains to extend these principles to other optical systems; to shew that in every such system, whether the rays be straight or curved, whether ordinary or extraordinary, there exists a Characteristic Function analogous to that which we have already pointed out for the case of the systems produced by the ordinary reflexion of light; to simplify and generalise the methods that we have given, for calculating from the form of this function all the other properties of the system; to integrate various equations which present themselves in the determination of mirrors, lenses, and crystals satisfying assigned conditions; to establish some more general principles in the theory of SYSTEMS OF RAYS, and to terminate with a brief review of our own results, and of the discoveries of former writers. But we have trespassed too long at present on the indulgence of mathematicians, and of the Academy, and must defer to another occasion the completion of this extensive design.

W. R. HAMILTON.

Observatory,
April 1828.

A Phenomenon of the Rainbow, observed by R. Mant, D. D. M. R. I. A., *Lord Bishop of Down and Connor, Nov.* 14, 1826.

Read, April 2, 1827.

THIS phenomenon (vid. figure) was observed at the See House near Belfast, between three and four o'clock on Tuesday, Nov. 14, 1826. It remained till the setting of the sun. The colours of each bow were brilliant, but the centre one was the least so. It is not known how long it was visible, but it must have been at least ten minutes.

* * *

This phenomenon appears to afford an interesting illustration of the theory of the rainbow.* It cannot be doubted that the extraordinary, or centre bow, was occasioned by an image of the sun reflected from the surface of water (probably the Lough of Belfast). The description and figure answer exactly to this explanation. The inner and centre bows have their colours in the same order. They both appear to spring from the same points of the horizon, as they ought; because the *sum* of the heights of the two bows must be equal to twice the angle of the primary bow. The centre bow appears to mix itself with the exterior or secondary bow.

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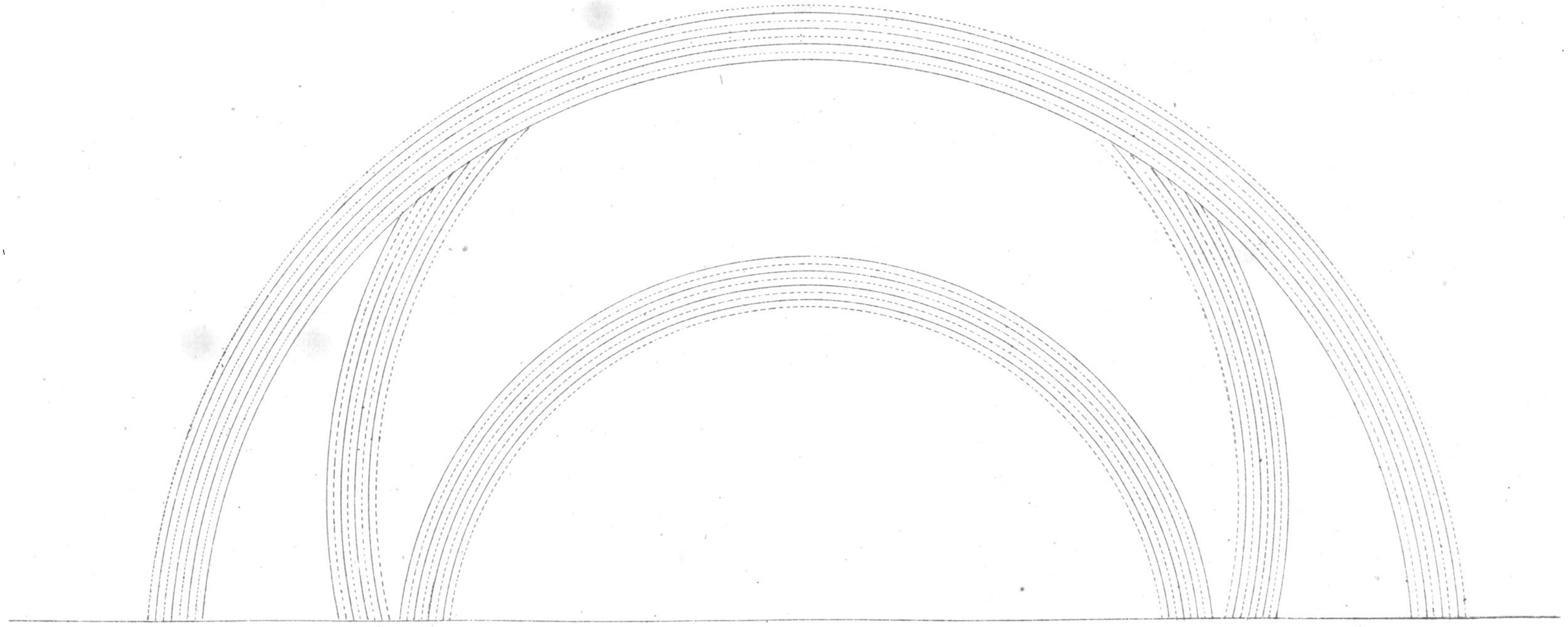
* A similar phenomenon was described in a periodical work published several years ago. Also recently, Mr. Scoresby, in Jameson's Edinburgh New Philosophical Journal, Vol. II. p. 235, has described some appearances of this kind observed in the North Seas, but these were much more imperfect than that observed by the Bishop of Down.

This circumstance enables us to point out with tolerable exactness when the observation, as represented in the drawing, was made. The interval between the primary and secondary bow being somewhat above 8°, the sun's altitude must have been about 4°. Now, on Nov. 14, in lat. 54°.36′, this took place about thirty-five minutes past three o'clock. It is said that it lasted at least ten minutes, and till sun-set. Probably what was supposed to be the setting of the sun was occasioned by its disappearing behind a low cloud. As the phenomenon does not appear to have been observed more than ten minutes, no material alteration would have taken place in the relative positions of the two primary bows.



Phenomenon of a Rainbow observed at the See House near Belfast